

Publications on Silicofluorides, Neurotoxicity, and Behavior

Roger D. Masters & Myron J. Coplan

I. Early Work by Other Authors

Kick C H, et al. (1935). *Fluorine in Animal Nutrition*, Bulletin 558 Wooster, OH: Ohio Experiment Station.

Bibby, B. G. (1946). "Topical Application of Fluorides as a Method of Combating Dental Caries," in Moulton FR, ed; *Symposium on Dental Caries and Fluorine*, Amer. Assn. for the Advancement of Science.

McClure, F. J., "Availability of Fluorine in Sodium Fluoride vs. Sodium Fluosilicate." *U.S. Public Health Service Report 65* (1950), pp. 1175-1186; reprinted in *Fluoride Drinking Waters* (Washington: US Public Health Service, 1962), 825: 527-532.

"In dilute aqueous solutions the hydrolysis of these two fluorine salts yielding fluoride ions is comparatively simple in the case of sodium fluoride, which is practically completely ionized, but quite complex and somewhat obscure in the case of sodium fluosilicate."¹ Following the specific chemical reactions "postulated" or suggested by chemists, McClure considers "the rate of retention and paths of excretion of fluorine" when ingested from these compounds, beginning by summarizing data in a 1935 study by Kick et al., who found that "there was no difference between sodium fluosilicate and sodium fluoride as regards the ultimate percent of fluorine retained in the rat's body, i.e., the percent fluorine balance in the above data. There were some differences, however, in the paths of excretion, i.e., in urine or feces." McClure's replication confirms data on percentage of fluorine retained but does not challenge Kick's finding of a difference in pathways of excretion (which is consistent with hypothesis of different biochemical side-effects from "residual species of silicate found by Westendorf).

Zipkin, I and McClure, F.J. (1950). "Complex Fluorides, Caries Reduction and Fluorine Retention in the Bones and Teeth of White Rats," *Public Health Reports* #66: 1523-1532.

Zipkin, I. and McClure, F.J., (1952). "Deposition of Fluorine in the Bones and Teeth of the Growing Rat," *J. Nutr.* 47: 611-620.

Weddle, D.A. and Muhler, J.C. (1957). The Metabolism of Different Fluorides in the Rat, *Journal of Dental Research*, 36: 386-390.

Feldman, I, Morkin, D, and Hodge, HC. (1957) "The State of Fluoride in Drinking Water," *Journal of Dental Research*, 36 (2): 192-202.

The first sentence of this article confirms that, at the time of their approval in 1950, the extent of dissociation of silicofluorides injected in a water supply was unknown: "The widespread use of sodium silicofluoride in fluoridating drinking water has made it important to determine the state of the fluoride in such water, specifically, how much is fluoride ion, how much, if any, is unchanged silicofluoride, how much is fluoride bound to other ions. If all or nearly all of the fluoride is the ion F^- , the great body of information about the biologic effects of fluorides can be brought forward as a guarantee of safety. If considerable amounts of silicofluoride remain, a question can legitimately be raised since comparatively little work has been done on the biologic effects of silicofluorides." (p.192). Despite the authors' claim to present (in 1957) "experimental results," their analysis is essentially a theoretical extrapolation which does not provide a direct test of chemical and biochemical effects under conditions approximating actual usage. Moreover, the claim of safety is limited to the extent of dissociation of fluoride, ignoring issues of biological effects of "residual species" of silicates such as those found by Westendorf.

Colton, E.. (1958). "Fluosilicic Acid." *Jour. of Chem. Educ.* 35:562-563.

Frant, M. and Ross, J.W. (1966). "Electrode for Sensing Fluoride Ion Activity in Solution," *Science*. 154:1553-55.

Crosby, N.T. (1969). "Equilibria of Fluosilicate Solutions with Special Reference to the Fluoridation of Public Water Supplies," *J. Appl. Chem* 19: 100-102.

Silicofluorides are unlikely to dissociate completely under water plant conditions, producing only free fluoride and silicic acid without side reactions because the silicofluoride moiety $[SiF_6]^{2-}$ can react with $Al(OH)_3$ to produce a number of derivative compounds. Moreover, silicofluoride residues may reassociate either within the stomach or in food preparation.

Knappwost A, Westendorf J, (1974) "Hemmung von Cholinesterasen durch Fluorokomplexe des Siliciums und des Eisens [Inhibition of cholinesterase by fluorocomplexes of silicon and iron]" *Naturwissenschaften* 61: 275.

First publication on research more fully reported in Westendorf, 1975.

Westendorf, Johannes (1975) . *Die Kinetik der Acetylcholinesterase Hemmung und Die Beeinflussung der Permeabilität von Erythrozytenmembranen durch Fluorid und Fluorokomplex-Ionen*; Doctoral Dissertation, Hamburg: Universität Hamburg Fachbereich Chemie; available in English translation at: <http://www.dartmouth.edu/~rmasters/ahabs>.

Experimental evidence showing that the extent of SiF dissociation into its component elements is at odds with the assumption that SiF and NaF are equivalent sources of free fluoride when used for water fluoridation. While the "residual species" of silicate remaining in water is not precisely identified, the thesis confirms potentially harmful biological effects (acetylcholinesterase inhibition). These demonstrations of biochemical

differences between silicofluorides and sodium fluoride have never been challenged with experimental data.

Manocha, S.L et al, (1975). "Cytochemical Response of Kidney, Liver and Nervous System to Fluoride Ions in Drinking Water," *Histochemical Journal*, 5: 343-355.

Busey, R. HJ. (1980) "Fluosilicate Equilibria in Sodium Chloride Solutions from 0 to 60° C" *Inorg. Chem* 19: 758-761.

Edelman, N. and Chow, L.C. (1991). "Effects of pH and Calcium on Hydrolysis of Na_2SiF_6 and Na_2SnF_6 ," *Caries Research*. 25: 101-107.

Whitford, G.M., Biles, E.D., Birdsong-Whitford. N.L. (1991). "A comparative study of fluoride pharmacokinetics in five species," *Journal of Dental Research*, 70: 948-51.

Whitford, G.M. (1994a). "Intake and metabolism of fluoride, " *Advances in Dental Research*; 8:5-14.

Whitford, G. M.. (1994). "Effects of plasma fluoride and dietary calcium concentrations on GI absorption and secretion of fluoride in the rat," *Calcif Tissue Int* 54:421-5.

Reeves, T.G. (1994). *Water Fluoridation; A Manual for Water Plant Operators*. Washington, DC: U.S. Public Health Service, Division of Oral Health.

Cory-Slechta, D. A. (1995). "Relationships between Lead Induced Learning Impairments and Changes in Dopaminergic, Cholinergic, and Glutamatergic Neurotransmitter System Functioning." *Annual Review of Pharmacology and Toxicology* 35: 391-454.,

Skoog, West, and Holler . (1996). The Direct Potentiometric Determination of Fluoride Ion, *Fundamentals of Analytical Chemistry*, Saunders, 7th Ed., pp. 850-852

Colquhoun, J. (1997). "Why I changed my mind about water fluoridation," *Perspectives in Biology and Medicine*. 41:29-44.

He H., Ganapathy V., Isales C.M., Whitford G.M. (1998). "pH-dependent fluoride transport in intestinal brush border membrane vesicles," *Biochem Biophys Acta* 1372: 244-254.

Whitford, G.M.. (1999). "Fluoride metabolism and excretion in children;" *Journal of Public Health Dentistry*, 593:224-228.

Featherstone, J.D.B. (2000). "The Science and Practice of Caries Prevention." *Journal of the American Dental Association*, 131: 887-100.

Burt B.A., Keels M.A, Heller K.E. (2000). "The effects of a break in water fluoridation on the development of dental caries and fluorosis," *J Dent Res*.79:761-769.

Ballabriga, A. (2000). "Morphological and physiological changes during growth: an update," *British Journal of Clinical Nutrition*, 54:S1-6.

Kunzel, W. and Fischer, T. (2000). "Caries prevalence after cessation of water fluoridation in La Salud, Cuba," *Caries Research*, 34:20-5.

Letter from Sally C. Gutierrez, Director, Water Supply and Water Resources Division, Office of Research and Development, National Risk Management Research Laboratory, U.S. EPA, Cincinnati to Roger Masters, March 15, 2001.

At a meeting in January 2001: "Several fluoride chemistry related research needs were identified including; (1) accurate and precise values for the stability constants of mixed fluorohydroxo complexes with aluminum (III), iron (III) and other metal cations likely to be found under drinking water conditions and (2) a kinetic model for the dissociation and hydrolysis (sic) of fluosilicates and stepwise equilibrium constants for the partial hydrolysis products. As a result of these discussions, ORD is exploring options to initiate research in the identified research areas."

(OFFICIAL CONFIRMATION THAT, WHEN APPROVED IN 1950, PRECISE CHEMISTRY AND BIOLOGICAL EFFECTS OF SILICOFLUORIDES WERE NOT FULLY KNOWN.)

Burgstahler, A.W., Freeman, R.F., Jacobs, P.N. (2002). "Early And Prolonged Toxic Effects of Silicofluoridated Water on Chinchillas, Caimans, Alligators, and Rats in Captivity," *Fluoride*. 35:259-260.

National Toxicology Program (2002), "NTP Nomination Of Silicofluorides For Study," *Federal Register* (June 12, 2002; Vol. 67, No. 113, p. 40329-33).

"Substances Nominated to the NTP for Toxicological Studies and Recommendations Made by the ICCEC on April 17, 2002. **"Table 1. -- Substances Recommended for Study Substance [CAS No.] ...** Hexafluorosilicic acid [16961-83-4] and Sodium hexafluorosilicate [16893-85-9]. **Nominated by:** Private Individuals (multiple nominations).

Nominated for: -Chemical characterization Toxicological characterization including chronic toxicity, carcinogenicity, neurotoxicity, and toxicokinetics. -Mechanistic studies related to cholinesterase inhibition and lead bioavailability. **Rationale for Nomination:** Primary agents used to fluoridate public drinking water systems; lack of toxicity information; assumed complete dissociation to free fluoride under normal conditions of use not supported by experimental evidence. **ICCEC**

Recommendations: - Chemical characterization studies to assess chemical fate under aqueous conditions -Toxicological studies may be

considered when results of chemical characterization studies are available for review.” Source: Above “information about substances nominated to the NTP for toxicology and carcinogenesis studies and the ICCEC's recommendations was published in This notice is available on the web (<http://ntp-server.niehs.nih.gov/htdocs/Liason/ICCECFinal02JuneFR.html>) along with supporting documents for each nomination: (<http://ntp-server.niehs.nih.gov/htdocs/liason/BkgrSum02June.html>)...” TO OUR KNOWLEDGE, NO RESULTS FROM A STUDY IMPLEMENTING THIS NOMINATION HAVE BEEN PUBLISHED. NOTE ALSO: THE POSSIBILITY THAT SILICIC ACID RESIDUES MIGHT BOND TO ALUMINUM COULD RELATE TO CONDITIONS LIKE AUTISM AND ALZHEIMER'S DISEASE (WHOSE APPARENT INCREASE IN FREQUENCY MIGHT BE DUE TO ALUMINUM NEUROTOXICITY).

Machalinski B, et al. (2003). "The influence of sodium fluoride and sodium hexafluorosilicate on human leukemic cell lines," *Fluoride*, 36: 231-40.

Seavey J. (2005). "Water fluoridation and crime in America," *Fluoride*: 38:11-22; & 38:174.

Cites work of Roger Masters and Myron Coplan, 1999a & 1999b.

Luo G., Niu R., Sun Z., Zhang J., Wang Jinming, Wang Jundong (2011), "Fluoride and Lead Combined Exposure Alters CaMKII Expression in Hippocampus of Rats," (Shanzi Agricultural University; in preparation)

Experimental demonstration that when rats are simultaneously exposed to both fluoride (from 150mg/L sodium fluoride in drinking water) and lead (from lead acetate), expression of Calcium/calmodulin-dependent protein kinase II (CaMKII) in hippocampus is significantly decreased. Since CaMKII is "a leading candidate in the search for the molecular basis of learning and memory," this effect is a plausible mechanism for harmful effects on educational performance associated with the combination of environmental exposures to lead and fluoride. Moreover, the hypothesized effects should be at least as great in communities with sources of exposure to lead (whether from industrial lead pollution, old housing with lead paint, or other sources of high lead in tapwater) and water treatment with silicofluorides (from which quantities of free fluoride are released). As a result, this study can be viewed as a model of a laboratory study of the effects of silicofluoride water treatment in American communities. While all behavioral findings are reinforced by this study, it is especially striking as an explanation for the Massachusetts data showing behavioral effects congruent with prediction of authors both in community frequencies of learning disabled students ["Neurotoxins, Disease, and Behavior," Fig. 12] and for scores on standardized MCAS tests in seven different subjects and grades ["Lead, Brain Chemistry, and Educational Faillure," Fig. 1]).

Babadi, V.Y., Sadeghi, L.; Shidrani, K.; Malekirad, A.A., Rezaei, M., (2014)
"Toxic Effect of Manganese on the Acetylcholinesterase Activity in Rat Brains,"
Journal of Toxicology, Article ID 96372, 4 pp.

"The pathological mechanisms associated with Mn neurotoxicity are poorly understood, but several reports have established it is mediated by changing of AChE activity that resulted in oxidative stress. Therefore we focused on the effect of Mn in AChE activity in the rat's brain by MnCl₂ injection intraperitoneally and analyzed their brains after time intervals....Results showed toxic effect of Mn is highly dose dependent and AChE activity in presence of chronic dose in 8 weeks reaches acute dose in only 2 days. (Abstract, p. 1)

Schneider, J.S. Williams, C.; Ault, M; Guilarte, T.R. (2015) "Effects of chronic manganese exposure on attention and working memory in non-human primates,"
Neurotoxicology, 48:217-222.

Manganese (Mn) is essential for a variety of physiological processes, but at elevated levels, can be neurotoxic. While cognitive dysfunction has been recently appreciated to occur as a result of chronic Mn exposures, it is still unclear as to which cognitive domains are most susceptible to disruption by Mn exposure. We previously decried early appearing Mn-induced changes in performance on a paired associate learning task in monkeys chronically exposed to Mn and suggested that performance of this task might be a sensitive too for detecting cognitive dysfunction resulting from Mn exposure. As chronic Mn exposure has been suggested to be associated with attention, working memory and executive function deficits, the present study was conducted to assess the extent to which detrimental effects of chronic Mn exposure could be detected using tasks specifically designed to preferentially assess attention, working memory and executive function These data suggest that in addition to the paired associate learning task, cognitive processing speed (as measured by the 5-CSRT) may be a sensitive measure of Mn toxicity and the brain circuits involved in performance of the SOSS task ['perform a self-ordered spatial search...task'] may be somewhat less sensitive to disruption by chronic Mn exposure.

Ellingsen, Dag G; Chashchin, Maxim; Bast-Pettersen, Rita; Zibarev, Evgenij; Thomassen, Yngvar; Chashhin, Valery (2015), "A follow-up study of neurobehavioral functions in welders exposed to manganese,," *NeuroToxicology* 47: 8-15.

Welders may be exposed to high amounts of manganese (Mn). In this study 63 welders and 65 referents were followed up with neurobehavioral tests approximately 6 years after the initial examination at baseline.... When subjects with sCDT above the upper reference limit of the laboratory (>=1/7%) were

excluded from the analyses, no difference in the decline in performance was observed between welders and referents for any of the applied neurobehavioral tests... Three welders had developed bradykinesia at follow-up, as assessed by a substantial decline in their Finger Tapping Test performance. They had also experienced a severe decline in Foot Tapping, Grooved Pegboard and Postural Sway Test Scores (while blindfolded), while postural tremor as assessed with the CATSYS Tremor 7.0 was normal."

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II. Publications co-authored by Roger Masters & Myron Coplan et al.

Masters, Roger D., with Baldwin Way, Brian T. Hone, David J. Grelotti, David Gonzalez, and David Jones (1997) "Neurotoxicity and Violence," *Vermont Law Review*, 22:358-382.

Legal implications of the evidence linking neurotoxicity and crime (including data from Toxic Release Inventory and crime for partial sample of US counties)

Masters, R, Hone, B, and Doshi, A. (1998). "Environmental Pollution, Neurotoxicity, and Criminal Violence," in J. Rose, ed., *Environmental Toxicology: Current Developments* (London: Gordon and Breach, 1998), pp. 13-48.

Survey of evidence linking lead and manganese neurotoxicity to aggressive behavior and crime, presenting multivariate analysis correlating Toxic Release Inventory for lead and manganese with crime data for 1991 from all 3141 US counties. Emphasizes effects of heavy metals on neurotransmitter function and behavior.

Masters, R. and Coplan, M. (1999a) "Water Treatment with Silicofluorides and Lead Toxicity," *International Journal of Environmental Studies*, 56: 435-49

First published analysis of data linking silicofluoride treatment of public water supplies with higher uptake of lead, using survey of children's blood lead in Massachusetts (by town).

Masters, R. and Coplan, M. (1999b) "A Dynamic, Multifactorial Model of Alcohol, Drug Abuse, and Crime: Linking Neuroscience and Behavior to Toxicology," *Social Science Information*, 38:591-624.

Articulation of the linkages between neurotoxicity, brain chemistry, environmental pollution, and behavior (with focus on substance abuse and crime), using data from National Institute of Justice study of drug use in over 30,000 criminal offenders at time of arrest). Data show that where silicofluorides are in use, criminals are more likely to consume alcohol, more likely to have used cocaine at time of arrest – and that communities have significantly higher crime rates.

Coplan, M.J. and Masters, R.D. (1999). "Is Silicofluoride Safe? Comments Re EPA Response to Rep. Calvert's Inquiry" Submission to Representative Kenneth Calvert, Subcommittee on Energy and Science, Committee on Science, U. S. House of Representatives (August 12, 1999).

Analysis and rejoinder to letter dated 12 June 1999 from J. Charles Fox, Assistant Administrator, EPA, to Hon. Kenneth Calvert, U. S. House of Representative, commenting on errors and omissions in a "Question and Answer" statement and "Fluorosilicate Fact Sheet" enclosed by Mr. Fox.

This document contains a preliminary review of scientific data on the differences between sodium fluoride (NaF) and the silicofluorides (H₂SiF₆ and Na₂SiF₆), with an emphasis on the complex production process and chemical interactions of the latter compounds.

Masters, R. D. and Coplan, M. J., with Hone, B.T., Grelotti, D. J., Gonzalez, D. and Jones, D. (1999). "Brain Biochemistry and the Violence Epidemic: Toward a 'Win-Win' Strategy for Reducing Crime," in Stuart Nagel, ed., *Super-Optimizing Examples Across Public Policy Problems* (NOVA Science Publishers)

Review of the evidence linking neurotoxicity and crime, using data from both county-level study (correlating EPA Toxic Release Inventory with FBI crime reports) and Massachusetts data on silicofluorides and lead uptake.

Wilson, Jim (1999). "The Chemistry of Violence," *Popular Mechanics*, (April), pp. 42-43.

Summary of findings from our project

Masters, R.D., Coplan, M. J., Hone, B.T., and Dykes, J.E. (2000). "Association of Silicofluoride Treated Water with Elevated Blood Lead," *Neurotoxicology* 21: 1091-1100.

Follow-up epidemiological study of the association between silicofluoride treated community water and enhanced child blood lead parameters. This statistical study of 151,225 venous blood lead (VBL) tests taken from children ages 0-6 inclusive, living in 105 communities with populations from 15,000 to 75,000 in New York state, shows for every age and racial group a significant association between silicofluoride treated community water and elevated blood lead.

Roger D. Masters (2001), "Biology and Politics: Linking Nature and Nurture" in Nelson W. Polsby, ed., *Annual Review of Political Science*, vol. 4, pp. 345-369.

A survey of the scope of the emerging subfield called "biopolitics," reflecting the activities of the membership of the Association for Politics and the Life Sciences. Four areas are discussed in some detail: 1). genetics and health; 2), toxins and behavior (including hyperactivity, depression, and violent crime), 3) the specific case of silicofluorides in water treatment and their effect in enhancing lead uptake; and 4) biopolitics and political theory.

Note: one-time e-print available at following URL:

<http://polisci.annualreviews.org/cgi/content/full/4/1/345?ijkey=0K1GnNcUKf2Gg&keytype=ref&siteid=arjournals>

Myron J. Coplan and Roger Masters. (2001). "Guest Editorial: Silicofluorides and fluoridation," *Fluoride: Quarterly Journal of the International Society for Fluoride Research*, 34: 161-220.

Given data showing harmful side-effects of water treated with hydrofluorosilicic acid or sodium silicofluoride, a moratorium is desirable on continued use of silicofluorides until such time as they are shown to be safe (and contrary findings explained).

Masters, R.D. (2002). "MacLean's Evolutionary Neuroethology: Environmental Pollution, Brain Chemistry, and Violent Crime," Gerald A. Corey Jr. & Russell Gardner Jr., eds. *The Evolutionary Neuroethology of Paul MacLean* (Westport: Praeger), pp. 275-296 (Ch. 15).

Survey of research on neurotoxicity, brain chemistry and behavior, including evidence of the role of lead and other heavy metal pollution and crime (as demonstrated by individual data, neurochemistry, and both geographic and longitudinal data) as well as survey of data linking silicofluorides to enhanced lead uptake. First presentation of findings on the extremely high correlation ($r = .90$) between gallons of leaded gasoline sold and the crime rates sixteen years later, confirming special vulnerability of pregnant mothers and newborns to lead toxicity.

Masters, Roger D. (2003). "The Social Implications of Evolutionary Psychology: Linking Brain Biochemistry, Toxins, and Violent Crime," in Richard W. Bloom and Nancy K. Dess, eds., *Evolutionary Psychology and Violence: A Primer for Policymakers and Public Policy Advocates* (Westwood: Praeger), Ch. 2, pp. 23-56.

Analysis of evidence of neurotransmitter dysfunction due to toxins associated with increased rates of violent crime, with extensive discussion of silicofluoride neurotoxicity as an important instance.

Masters Roger D. (2005). "A Moratorium on Silicofluoride Usage will Save \$Millions," *Fluoride*, 38(1):1-5; cm 38(2):174.

Estimation of rates of harmful effects of water treated with silicofluorides, based on national county-level data for violent crime and other statistics, and corresponding costs to taxpayers. Total financial benefits to taxpayers are in the Millions – and probably Billions – of dollars, with virtually no costs to the public.

Masters, Roger D. (2006). "Science, Bureaucracy, and Public Policy: Can Scientific Inquiry Prevail Over Entrenched Institutional Self-Interest?" *New England Journal of Political Science*, 1: 58-140.

Richard P. Maas, Steven C. Patch, Anna-Marie Christian, Myron J. Coplan, "Effects of fluoridation and disinfection agent combinations on lead leaching from leaded-brass parts," *Neurotoxicology* (September 2007), 38: 1023-31.

Disinfection agents (chloramines as well as chlorine) have the effect of leaching lead from leaded-brass water fixtures, and this effect is significantly enhanced where fluoride compounds are also used to treat the water supply (with higher effects from long term combinations including fluorosilicic acid).

Myron J. Coplan, Steven C. Patch, Roger D. Masters, Marcia S. Bachman, "Confirmation of and Explanations for Elevated Blood Lead and Other Disorders in Children Exposed to Water Disinfection and Fluoridation Chemicals," *Neurotoxicology* (September, 2007), 38: 1032-1041.

Confirmation of association between silicofluoride use in local water supplies and significant increase in absorption of lead from environmental sources, using new children's blood lead data from National Health and Nutrition

Evaluation Survey III, counties of over 150,000 population. Review of important

new findings, including lead leaching from brass water fixtures where systems

combine use of silicofluorides with chloramine for disinfection; evidence confirming incomplete dissociation of silicofluorides (contradicting original "assumption" when silicofluorides were approved without testing by the

Public

Health Service in 1950); Westendorf's finding of acetylcholinesterase inhibition,

interference with cholinergic function; and other evidence confirming research

hypotheses and data explanations in our previous published research.

Masters, Roger D. (July-Sept. 2009), "Cost and Effectiveness in American Health Care," Special Article, *International Journal of Health Science*, II, 221-226.

Analysis of high cost and disappointing outcomes of American health care

system when compared to other industrialized countries. The U.S. has average per capita health costs over twice the OECD average, but a year less of life expectancy and over 1 additional infant death per 1,000 live births. This paradox

is explained by the great expense of health care for the uninsured, which is a hidden cost associated with the low percent of American

health costs that's supported by public funding (only 45.8%), compared to the average of 73% public health

financing for all OECD countries. Preventive care (epitomized by

reducing toxic exposure and uptake) has the potential to improve outcomes at low cost.

Masters, Roger D., "Toxins, and Violent Crime," *Biopolitics: the Life Sciences and Public Policy: Research in Biopolitics* (2012), 10, 119-156.

A study testing the hypothesis that a neuroscientific analysis of brain and behavior can explain hitherto unexplained local differences in rates of violent crime, to explore whether these behavior are significantly influenced both by local exposure to either fluorosilicic acid or sodium silicofluoride (together "SiF") -- toxic compounds used in place of sodium fluoride (NaF) in over 90% of fluoridated water in the U.S. Multivariate

statistical analysis confirms the predicted association between SiF and violent crime as well as the hypothesis that "children in communities using SiF should have increased uptake of lead from environmental sources and higher rates of behavioral dysfunctions known to be caused by lead neurotoxicity."

Masters, Roger, "On the Relationship between Liberalism and Darwinism," in Stephen Dilley, ed., *Darwinian Evolution and Classical Liberalism* (Lanham, Boulder & N.Y.: Lexington Books, 2013), ch. 10, pp. 217-236.

Contrary to the prevailing gulf separating the social sciences from contemporary biology, this essay explores parallels between the Darwinian theoretical approach to human social behavior as a product of evolutionary biology and the tradition of "classical liberalism" from Locke to the present, based on "the core concept" of "freedom from the restraints of political, social and theological practices and power structures that block innovation in social behavior."

Kennedy, David; Seneff, Stephenie; Davidson, Robert M.; Haley, Boyd E.; & Masters, Roger D., "Environmental Toxicants and Infant Mortality," accepted pending acceptance of revision by ENTROPY (ISSN 2099-4300).

This article presents a highly innovative exploration of the relationship between "environmental toxicants" (i.e., toxins intentionally added to the environment) and the public policies of "water fluoridation" as factors contributing the relatively high rates of infant mortality in the U.S. My contribution explained the role of silicofluorides in the chemical process by which the aluminum adjuvants added to vaccines to increase their effectiveness bonds to fluoride (from water treatment) to form highly toxic aluminum fluoride (Al_2F_3). Given the relationship between aluminum fluoride and higher rates of many diseases (explored elsewhere in this volume), the ability to end the use of silicofluorides by listing these compounds under the Toxic Substances Control Act, §5-6 might make it possible to end this source of disease without a highly controversial attempt to end the use of aluminum adjuvants in vaccines.

Articles in Preparation

Masters, Roger D., "Neurotoxins, Disease, and Behavior," (in manuscript), Poster proposal for First Annual Neuroscience, Behavior and Health Research Forum, University of Vermont Medical School (Jan. 21-22, 2011).

Survey of wide variety of outcomes for which data provide evidence of harmful

effects of toxins and their exacerbation by presence of water treated with silicofluorides.

Masters, Roger D. & Coplan, Myron J., (in manuscript), "Behavioral Effects of Water Toxicity: An Unexpected Problem in Experimental Methodology" (UNPUBLISHED)

John Crabbe, Jr.'s ambitious attempt to demonstrate the importance of the principle of replication in experimental behavioral neuroscience had an unintended consequence, which was viewed in as evidence that such scientific studies are in principle impossible to replicate. Crabbe conducted a series of behavioral experiments with 16 different strains of rats, taking great pains to insure that handling of animals and all experimental protocols were as identical as possible in three different Canadian cities. To his disappointment, rats in one of the three cities did not exhibit an aversion to entry in the dark arm of a "Y maze" -- which seemingly meant that the experiment failed to have reproducible effects. In fact, however, one of the "controls" was the use of "tap water" for all animals. Of the three cities, only one -- Edmonton, Alberta -- treats its public water supplies with silicofluoride, and it was in that city that the rats failed to learn reliably and impulsively entered the dark arm of the maze more often than expected. Far from being a demonstration of non-reproducibility, therefore, Crabbe and his colleagues provided experimental evidence confirming our hypotheses on the neurotoxic effects of silicofluoride treated water. As a result, this study not only strengthens our findings; it also suggests a possible danger in reproducibility for laboratory studies if water treatment systems differ from one test to another.

Masters, Roger D. (UNPUBLISHED). "Lead, Brain Chemistry, and Educational Failure"

Multivariate statistical analyses of outcome variables related to learning and educational systems are considered in the light of the established hypotheses in cognitive neuroscience and neurotoxicology. As a result, many negative outcomes attributed to poor teaching staff or racial inferiority illustrate the gene-environment interactions associated with impulse control and learning.

Roger D. Masters* & Myron J. Coplan**

Presentations to Scientific Conferences:

Masters, R.D. and Coplan, M.J. "Silicofluoride Usage and Lead Uptake," Presentation to XXIIInd Conference of the International Society for Fluoride Research, Bellingham, Washington, August 24-27, 1998.

Report on findings of elevated blood lead associated with communities using silicofluoride, based on sample of over 250,000 children in Massachusetts (see Masters and Coplan, 1999a)

Masters, R. D. . "Poisoning the Well: Neurotoxic Metals, Water Treatment and Human Behavior," Plenary address to Annual Conference of the Association for Politics and the Life Sciences," Four Seasons Hotel, Atlanta, GA (September 2, 1999).

Review of evidence linking heavy metal pollution with substance abuse and crime, including presentation of data linking ban on sales of leaded gasoline with decline in crime 16 years later. Summary of geographical data analyses contradicting the "null hypothesis" that there is no difference in the effects of sodium fluoride and the silicofluorides.

Coplan, M. J., Masters, R. D., and Hone, B. (1999a) "Silicofluoride Usage, Tooth Decay and Children's Blood Lead," Poster presentation to Conference on "Environmental Influences on Children: Brain, Development and Behavior, New York Academy of Medicine, Mt. Sinai Hospital, New York, May 24-25, 1999.

Preliminary report on data from analysis of national sample of over 4,000 children in NHANES III, showing that while water fluoridation is associated with a significant increase in children's blood lead (with especially strong effects among minority children), data on tooth decay from the same survey show limited benefits that are no longer evident among those aged 15-17.

Coplan, M.J., Masters, R.D., and Hone, B. (1999b) "Association of Silicofluoride Treated Water with Elevated Blood Lead," Poster presentation to 17th International Neurotoxicology Conference, Little Rock, AR, October 17

Preliminary report on data from analysis of sample of blood lead testing of over 150,000 children in New York State communities of 15,000 to 75,000 population. Once again, average blood lead levels were significantly higher ($p < .0001$) in communities using silicofluorides in water treatment than in those with unfluoridated water. The effect was found independently in every age group for three ethnic subsamples

Roger D. Masters (2002) "Science, Bureaucracy, and Public Policy: Can Scientific Inquiry Prevail Over Entrenched Institutional Self-Interest?" presentation at the annual meeting of the Association for Politics and the Life Sciences, Montreal, Que. (August 19-23, 2002).

Analysis of bureaucratic opposition to reconsideration of public policy decisions challenged by new data on silicofluoride chemistry and its effects on human biology and behavior.

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